

Abstract

The invention is an apparatus for physically exchanging a force with a user in an environment local to the user. A connection element connects to a user's body member and a linkage between the connection element and ground. The linkage includes means for powering at least three independent freedoms of the connection element relative to ground and means for maintaining at least one independent freedom of the connection element relative to ground free of power. Up to three independent freedoms of the connection element may be maintained free of power, and up to five independent freedoms may be powered. Other aspects of the invention include a two actuator counter-balance for controlling a point on a link. The invention also includes apparatus for establishing a virtual, switch, which presents to the user the force and displacement relationship of a spring switch. Another embodiment is a virtual bristled brush, again which presents to the user the force and displacement relationship of such a brush, while also changing the virtual environment to reflect the user's changes in location.